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Comparative sedimentology of Holocene reefs and the role of sea level, subsidence, and climate in reef accretion

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Apart from manifold scientific interests, Holocene reef accretion is crucial for the survival and well-being of millions of people, especially for those living on low-lying reef islands. Subsurface data from three prominent reef locations in the Atlantic, Indian, and Pacific Oceans have been analyzed and factors such as sea level, subsidence, and climate variations during the Holocene are discussed. On Belize barrier and atoll reefs (western Atlantic), marginal reef accretion rates range from 0.81 - 6.59 (mean 3.03 m/kyr, n=33) and decrease during the Holocene. Differences in coral associations between windward and leeward reefs exist but keep-up types predominate in both settings. In the Maldives (Indian Ocean), marginal reefs have been accreting by 0.17 - 17.6 m/kyr (mean 6.37 m/kyr, n=18). No major differences in coral composition and reef accretion style (keep-up) are seen between windward and leeward. The barrier reef of Bora Bora (south Pacific) accreted by 1.39 - 13.09 m/kyr (mean 6.15 m/kyr, n=19). Coralgal composition suggests upward shallowing during the Holocene. Sea-level rise and subsidence have created accommodation space for reef growth, with sea level being the major factor (30 m versus 1.5 m of max. Holocene gain in accommodation). In Bora Bora, a significant correlation between reef accretion and Holocene climate data is visible. In both Belize and Bora Bora, there is evidence for reef progradation as a consequence of a decrease in rate of rise of sea level. Given the sea-level projections of the IPCC for the 21st century, only average values of the Indo-Pacific examples are well within the predicted rates of ca. 3-10 m/kyr.